

OBJECTIVES

- Work with map layers
- Zoom and pan
- Magnifier and Overview windows
- Spatial bookmarks
- Measure distances
- Identify features
- Select features on a map
- Find features
- Work with feature attribute tables
- Label features

GIS Tutorial 1

Introduction

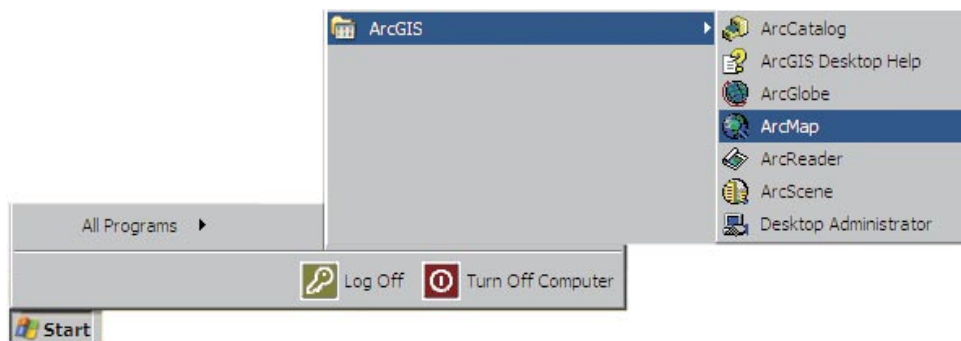
This first tutorial will make you familiar with some of the basic functionality of ArcMap™ and illustrate the fundamentals of GIS. You will work with map layers and underlying feature attribute data tables for U.S. states, cities, counties, and streets. All layers you will use are made up of geographic features consisting of points, lines, and polygons. Each geographic feature has a corresponding data record, and you will work with both features and their data records.

Launch ArcMap

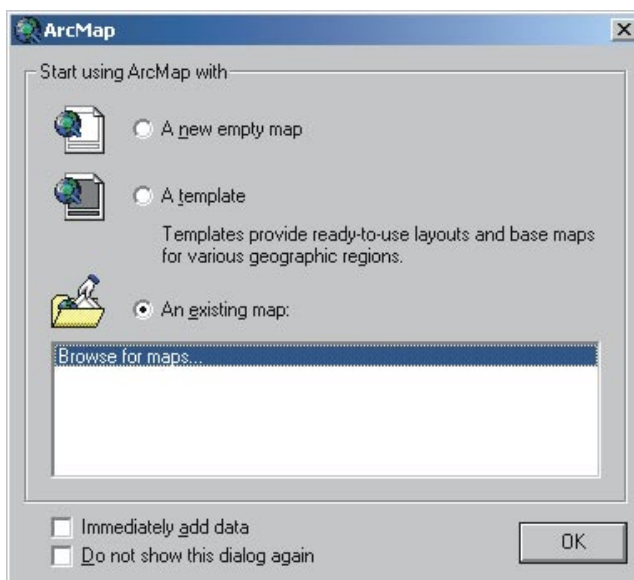
ArcMap is the primary mapping component of the GIS software known as ArcGIS Desktop. ArcGIS's vendor, ESRI, offers three licensing levels of ArcGIS Desktop with increasing capabilities, namely, ArcView, ArcEditor, and ArcInfo. Together, ArcMap and two other components that you will use later in this workbook (ArcCatalog™ and ArcToolbox™) make up ArcView, the world's most popular GIS software.

- 1 From the Windows® taskbar, click **Start, All Programs, ArcGIS, ArcMap**.

Depending on how ArcGIS and ArcMap have been installed or which Windows operating system you're using, there may be a slightly different navigation menu from which to open ArcMap.

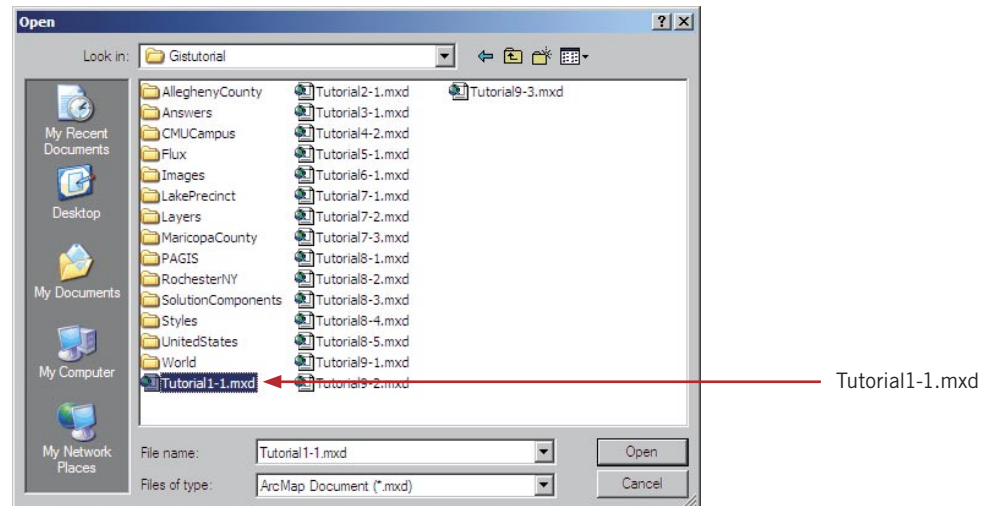


- 2 In the resulting ArcMap window, click the **An existing map** radio button and click **OK**.

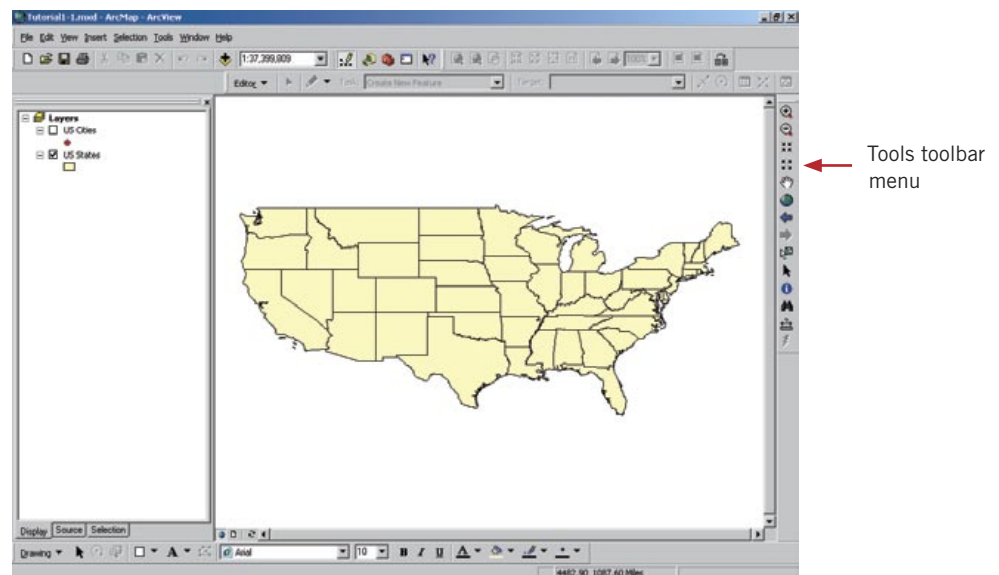


Open an existing map

- 1 Browse to the drive on which the Gistutorial folder has been installed (e.g., C:\Gistutorial), click the Tutorial1-1.mxd (or Tutorial1-1) icon and click **Open**.



The Tutorial1-1.mxd project opens in ArcMap showing a map consisting of the US States layer (boundaries of the lower forty-eight contiguous states). The US Cities layer (not yet turned on) is the subset of cities with population greater than 300,000. Note that your Tools menu, which is anchored on the right side of the screen below, may be free-floating on your screen or docked somewhere else on the interface. If you wish, you can anchor it by clicking in its top area, dragging it to a side of the map display window and releasing when you see a thin rectangle materialize. If you do not see the Tools menu at all, click View, Toolbars, Tools to make it visible.



Map layers

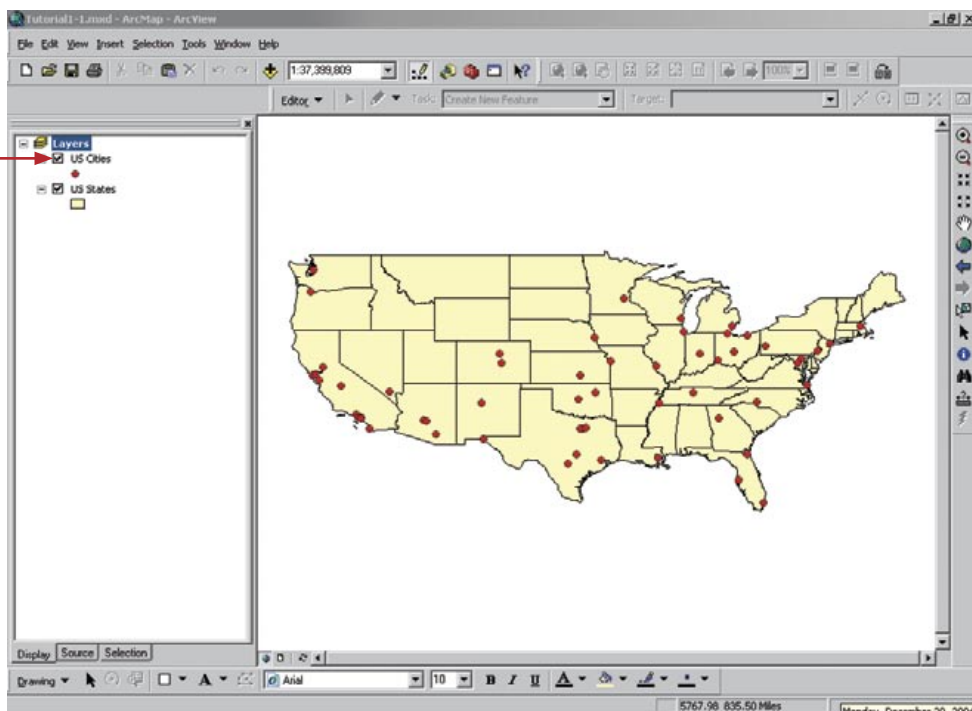
Map layers are references to data sources such as point, line, and polygon shapefiles; geodatabase feature classes; raster images; and so forth, representing spatial features that can be displayed on a map.

Turn a layer on

- 1 Click the small check box to the left of the **US Cities** layer in the table of contents to turn that layer on.

The table of contents is the panel on the left side of the view window. If the table of contents accidentally closes, click Window, Table of Contents to reopen it. A check mark appears if the layer is turned on. Nothing appears if it is turned off.

Check box
turns a layer
on and off
in the table
of contents

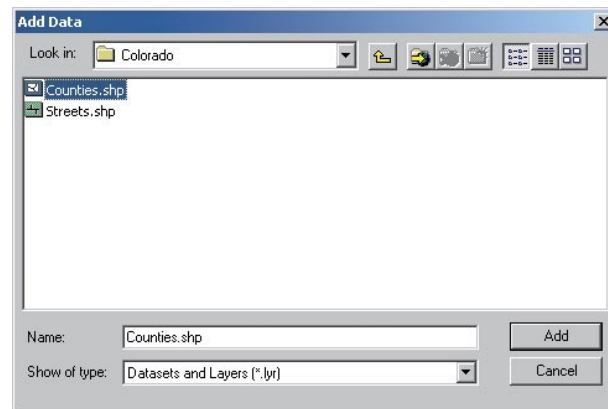


Turn a layer off

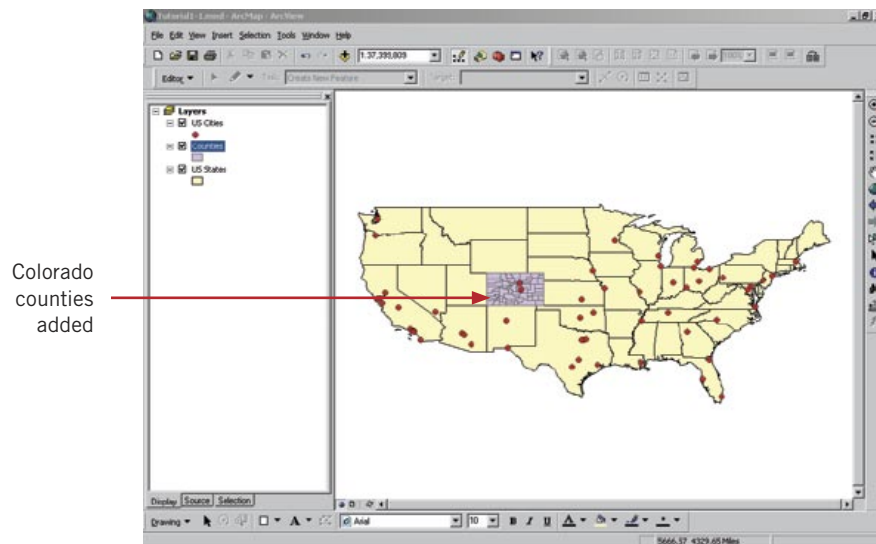
- 1 Click the small check box to the left of the **US Cities** layer in the table of contents again to turn the layer off.
- 2 Click the check box again to turn the layer on.

Add a layer

- 1 Click the Add Data button. 
- 2 In the Add Data browser, browse to \Gistutorial\UnitedStates\Colorado.
- 3 Click Counties.shp.
- 4 Click Add.



ArcMap randomly picks a color for the Colorado counties layer. The color can be changed later.



YOUR TURN

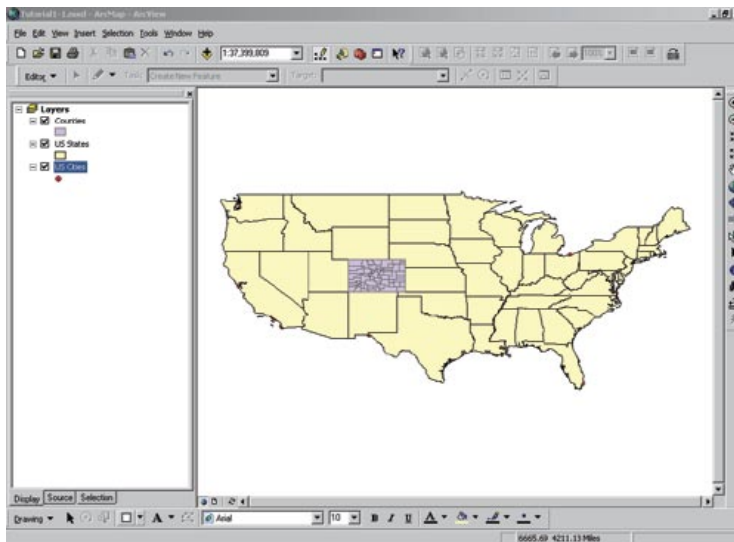
Use the Add Data button to add Streets.shp, also found in the \Gistutorial\UnitedStates\Colorado folder. These are street centerlines for Jefferson County, Colorado.

Note: Click OK if you see a message relating to projections.

Change a layer's display order

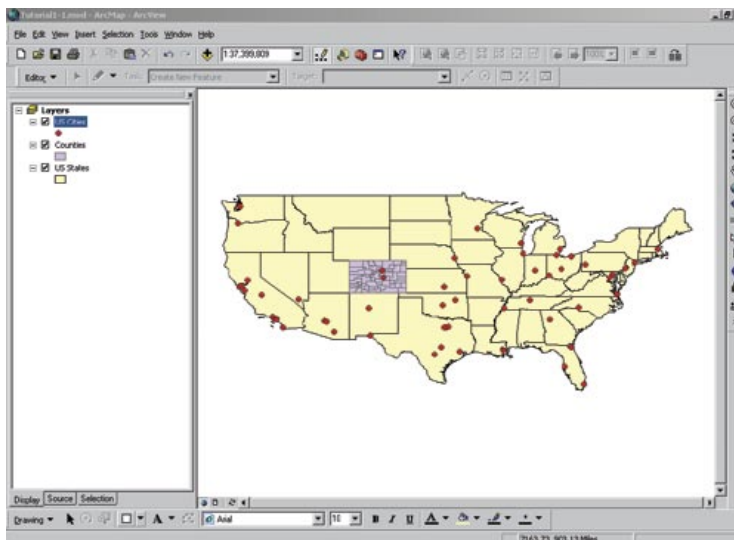
- 1 In the table of contents, click and hold down the left mouse button on the name of the **US Cities** layer.
- 2 Drag the **US Cities** layer down to the bottom of the table of contents.

ArcMap draws layers from the bottom up. Because the US Cities layer is now drawn first, its points are covered by the US States and Counties layers and cannot be seen.



- 3 Click and hold down the left mouse button on the **US Cities** layer.
- 4 Drag the **US Cities** layer back to the top of the table of contents.

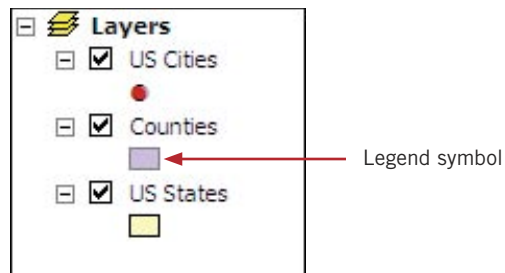
Because US Cities is now drawn last, its points can be seen again.



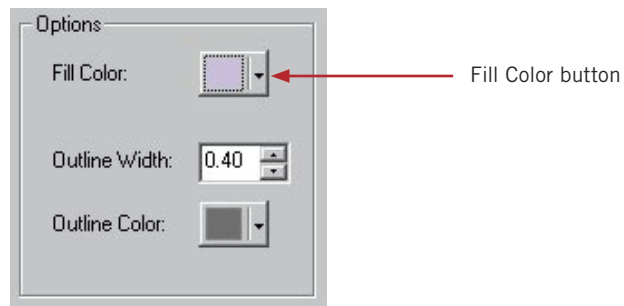
Change a layer's color

- 1 Click the Counties layer's legend symbol.

The legend symbol is the rectangle below the layer name in the table of contents.



- 2 In the resulting Symbol Selector window, click the Fill Color button in the Options section.



- 3 Click the Tarragon Green tile in the Color Palette.

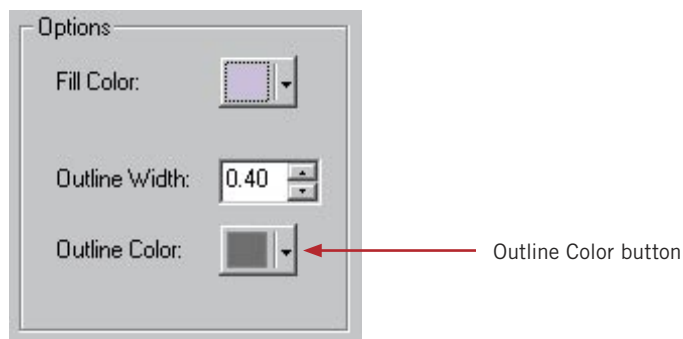


- 4 Click OK.

The layer's color will change to Tarragon Green on the map.

Change a layer's outline color

- 1 Click the Counties layer's legend symbol.
- 2 Click the **Outline Color** button in the Options section of the Symbol Selector dialog box.



- 3 Click the **Apple Dust** tile in the Color Palette.



- 4 Click **OK**.

The effect of colors on maps will be explored more in chapter 2 of the tutorial.

YOUR TURN

Repeat the steps outlined above, this time changing the colors for the other layers to your liking.

Zoom and pan

Zooming and panning enlarges or reduces the display and shifts the display to see different areas of the map. The zoom and pan buttons are found on the Tools toolbar.



Zoom In

- 1 Click the **Zoom In** button.



- 2 Click and hold down the mouse button on a point above and to the left of the state of Florida.
- 3 Drag the mouse below and to the right of the state of Florida and release the mouse button.



- 4 Click once on the screen to zoom in, centered on the point that you clicked.

This is an alternative to dragging a rectangle for zooming in.

Fixed Zoom In

- 1 Click the **Fixed Zoom In** button.



This zooms in a fixed distance on the center of the current zoomed display.

Zoom Out

- 1 Click the **Zoom Out** button. 
- 2 Click once on the map to zoom out from the point you pick.

Fixed Zoom Out


- 1 Click the **Fixed Zoom Out** button.



This zooms out a fixed distance from the center of the current zoomed display.

Pan

Panning shifts the current display to the left, right, up, or down without changing the current scale.

- 1 Click the **Pan** button. 
- 2 Move the cursor anywhere onto the map display.
- 3 Hold down the left mouse button and drag the mouse in any direction.
- 4 Release the mouse button.

Zoom to Full Extent

- 1 Click the **Zoom to Full Extent** button.



This zooms to a full display of all layers, regardless of whether they are turned on or turned off.

Zoom to the Previous Extent

- 1 Click the **Zoom to Previous Extent** button.



This returns the map display to its previous extent. Continue to click this button to step back through the views.

Zoom to the Next Extent

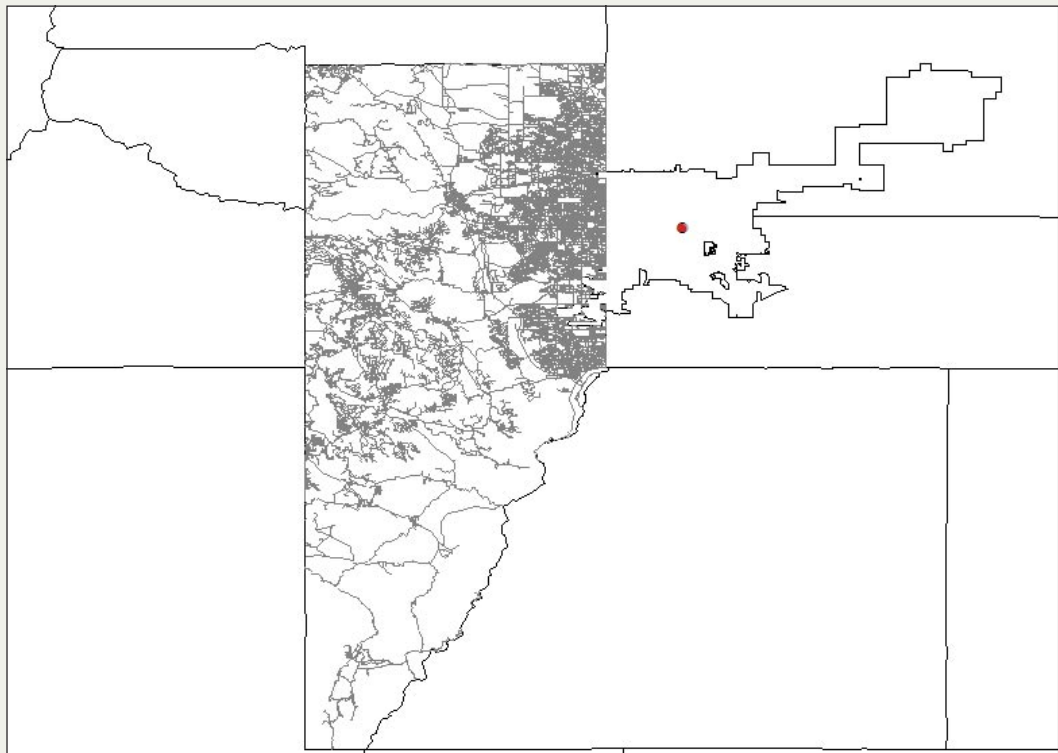
- 1 Click the **Zoom to Next Extent** button.



This moves forward through the sequence of zoomed extents you have viewed. You can continue to click this button until you reach the most recently viewed extent.

YOUR TURN

Zoom to the county polygons in Colorado and streets in Jefferson County, Colorado.

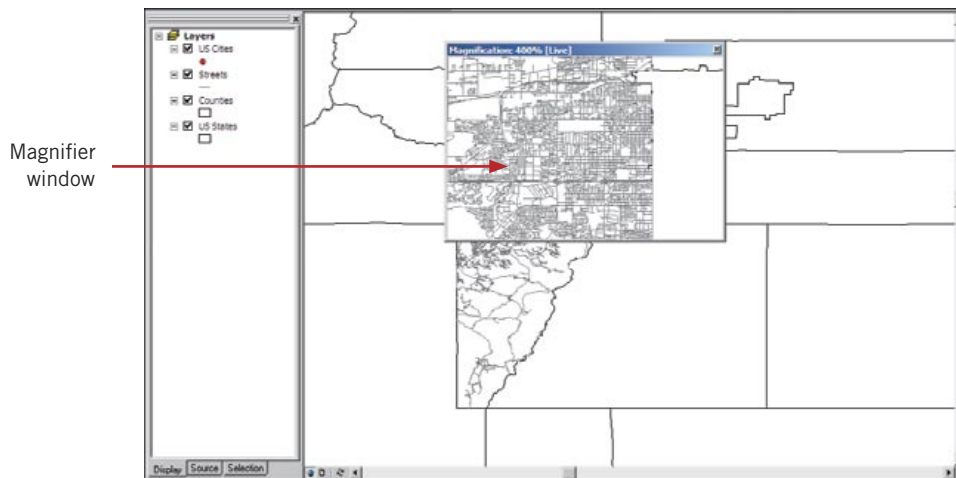


Magnifier window

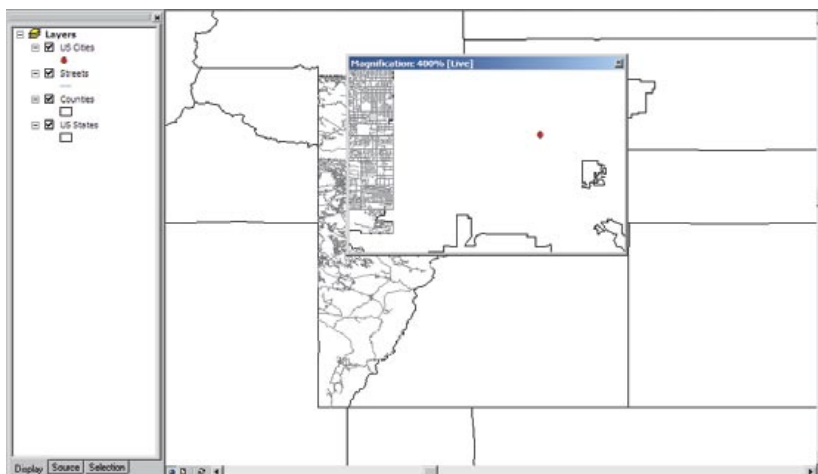
The magnifier window adjusts the map display to see more detail or get an overview of an area. This window works like a magnifying glass; as you pass the window over the map display, you see a magnified view of the location under the window. Moving the window does not affect the current map display.

Opening the magnifier

- 1 Click **Window, Magnifier**.
- 2 Drag the magnifier over an area of the map to see cross hairs for area selection and then release to see the zoomed details.

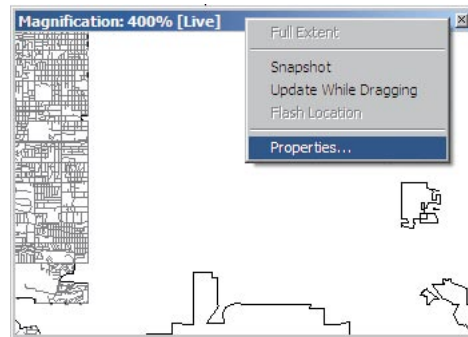


- 3 Drag the magnifier to a new area to see another detail on the map.

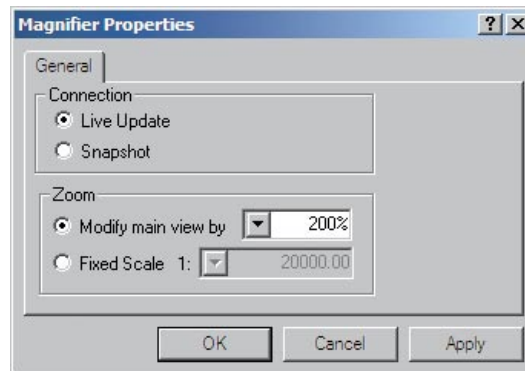


Magnifier properties

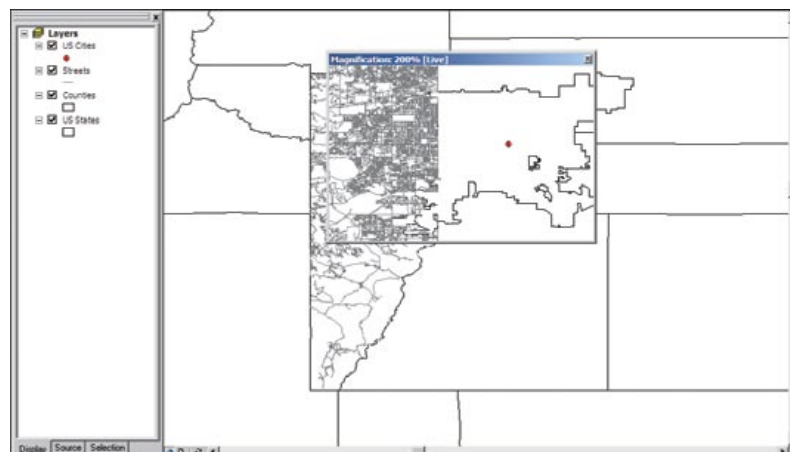
- 1 Right-click the title bar of the magnifier window.



- 2 Click Properties.



- 3 Change the Zoom percentage to 200%.
- 4 Click OK.
- 5 Drag the magnifier to a different location and see the resulting view.



- 6 Close the magnifier window.

Overview window

The Overview window shows the full extent of the layers in a map while also showing the area currently zoomed to in the map display with a red box. You can move the red box to pan the map display. You can also make the red box smaller or larger to zoom the map display in or out.

Opening the Overview window

- 1 Click **View, Zoom Data, Full Extent**.
- 2 Zoom to a small area of the map (one or two states).



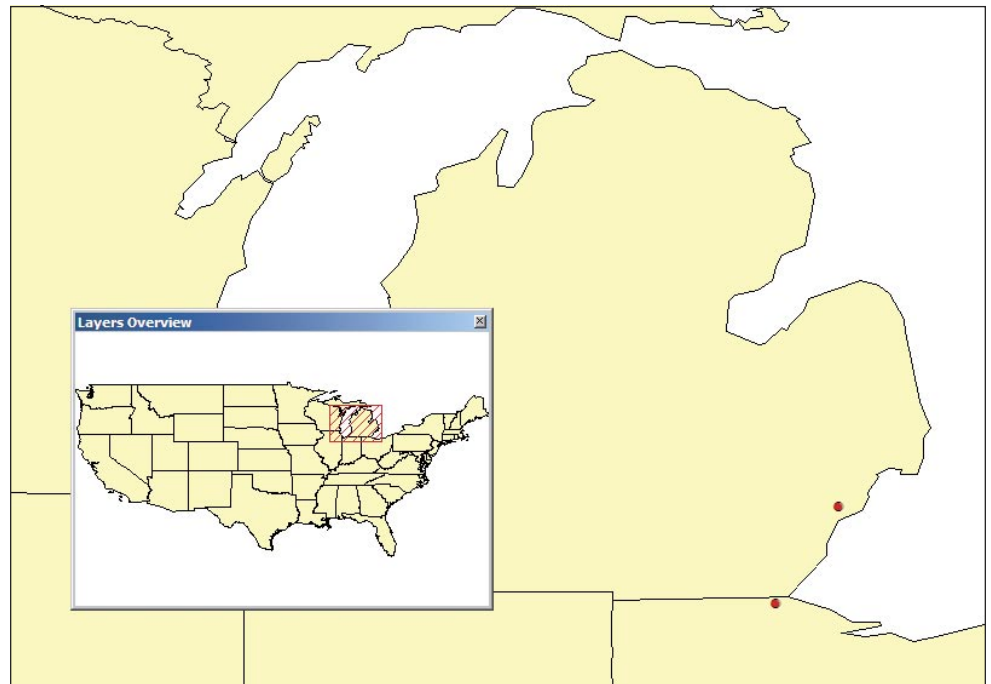
- 3 Click **Window, Overview**.

The current extent of the map display will be highlighted with a red hatch pattern.

- 4 Move the cursor to the center of the hatch pattern and click and drag to move it to a new location.



The extent of the map display updates to reflect the changes made in the Layers Overview window.



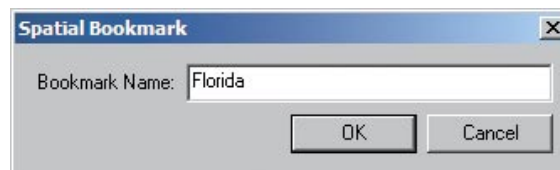
Spatial bookmarks

Spatial bookmarks save the extent of a map display or geographic location so you can return to it later without having to use the Pan and Zoom tools.

- 1 Close the Layers Overview window.
- 2 Click **View, Zoom Data, Full Extent**.



- 3 Zoom to the state of Florida.
- 4 Click **View, Bookmarks, Create**.
- 5 Type **Florida** in the Bookmark Name field.
- 6 Click **OK**.
- 7 Click **View, Zoom Data, Full Extent**.
- 8 Click **View, Bookmarks, Florida**.




ArcMap will automatically zoom to the saved bookmark of Florida.

YOUR TURN

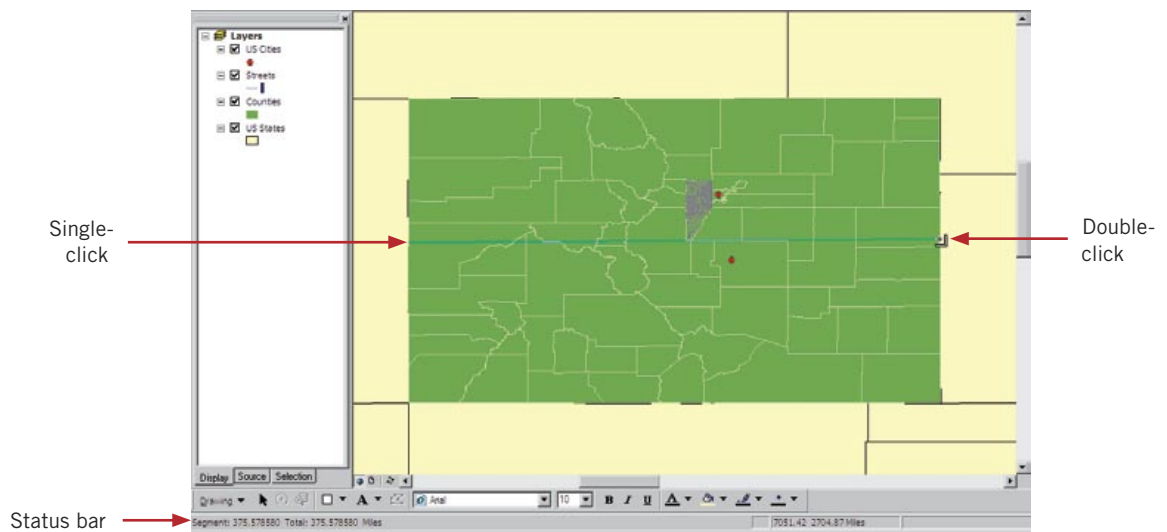
Create spatial bookmarks for the states of California, New York, and Colorado. Try out your bookmarks. Use **View, Bookmarks, Manage** to remove the California bookmark.

Measure distances

Measure the horizontal distance of Colorado

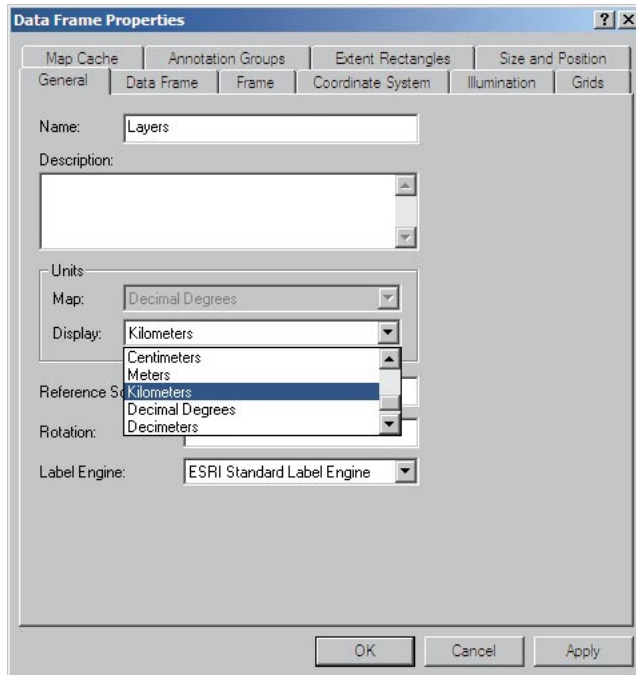
- 1 Use your bookmark (or use the Full Extent and Zoom In tools) to zoom to Colorado.
- 2 From the Tools toolbar, click the **Measure** button. 
- 3 Click once on the left boundary of the state of Colorado.
- 4 Drag the mouse to the right boundary of Colorado and double-click.

The resulting distance is shown on the status bar found on the lower left corner of the screen. The distances for this layer are shown in miles. The distance should be about 375 miles.



Change distance measurements

- 1 Click **View**, **Data Frame Properties**, and the **General** tab.
- 2 In the **Units** frame, change the **Display units** to **Kilometers**.
- 3 Click **OK**.



YOUR TURN

Measure the vertical distance (top to bottom) of Colorado.
The distance should be about 275 miles or 445 kilometers.

Change the display units back to miles and measure the length and height of the United States.
The length is approximately 2,700 miles and the height 1,600 miles, but these measurements are difficult to make precisely.

Identify features

The Identify tool displays the data attributes of a feature by clicking the feature on the map. This tool is the easiest way to learn something about a location in a map.

Identify various U.S. states

- 1 Turn off all layers except US States.

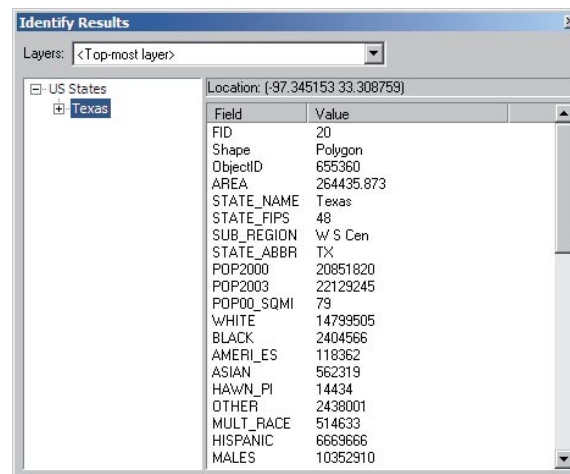


- 2 From the Tools toolbar, click the Identify button.

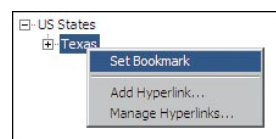


- 3 Click inside the state of Texas.

The state will temporarily flash and its attributes appear in the Identify Results dialog box.



- 4 Right-click the name of the feature in the left window (in this case Texas) and click Set Bookmark.

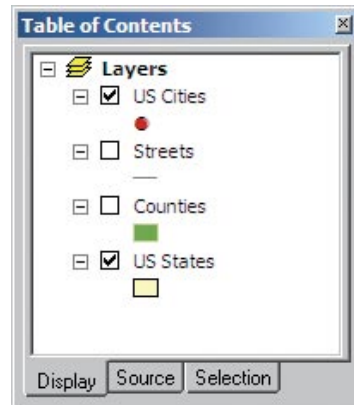


ArcMap will create a zoomed bookmark of that feature.

- 5 Close the Identify Results window.

Identify various U.S. cities

- 1 Turn the US Cities layer on.

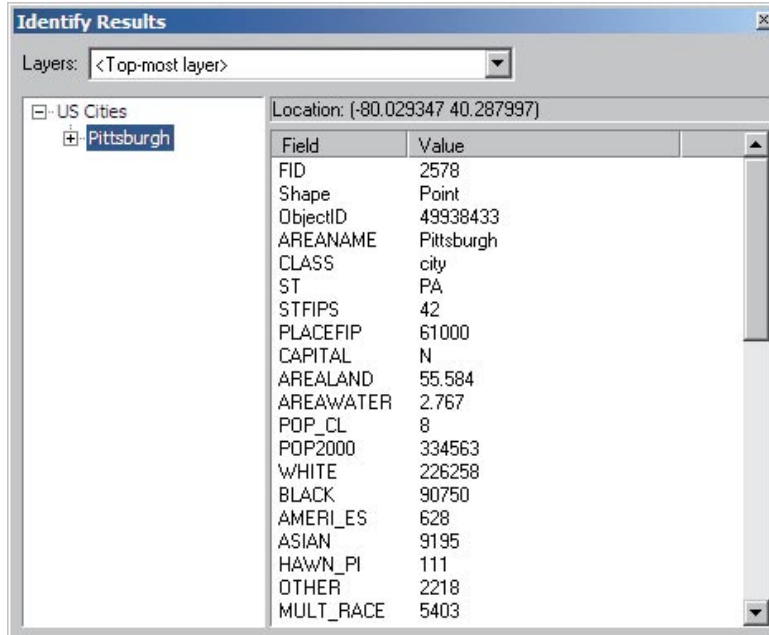


- 2 Click the Identify button.



- 3 Click any of the points for the cities.

Make sure the point of the arrow is inside the circle when you click the mouse button. Notice which feature flashes—that is the feature on which you will get information. If the entire state flashes, you have missed the city and the Identify Results dialog will give you information about the state and not the city.



- 4 Continue clicking other states to see the identify results.

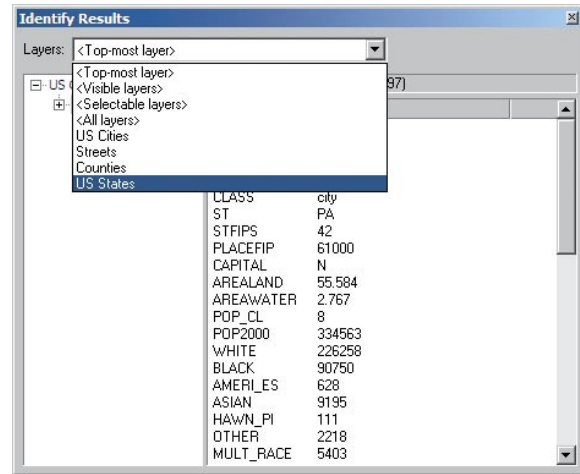
ArcMap will identify the features in the layer at the top of the Table of Contents first (top-most layer). Since US Cities is above US States, it will be identified first. Hold down the Shift key to pick multiple cities.

Restricting Identify Results

1 Click the **Layers** drop-down list in the Identify Results dialog.

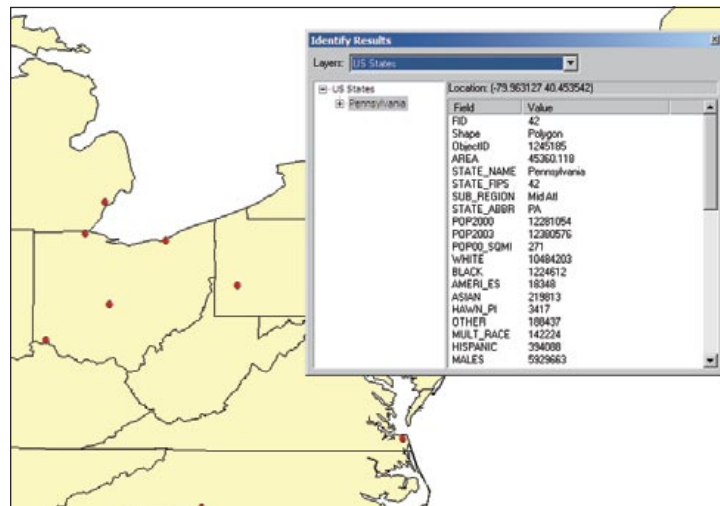
2 Click **US States**.

This will restrict the Identify selection to features in this layer only and will ignore features in the other layers.



3 Click any city point feature.

ArcMap will identify the US States only because its layer is set in the dialog box.



4 Close the **Identify Results** window.

YOUR TURN

Restrict the Identify Results to the US Cities layer and identify cities. Practice making bookmarks for various cities. Also see if you can remember how to go to the bookmarks once they have been created.

Selecting features

Selecting features identifies the features on which you want to perform certain operations. For example, before you move, delete, or copy a feature, you must select it. Selected features also appear highlighted in the layer's attribute table and in the map.

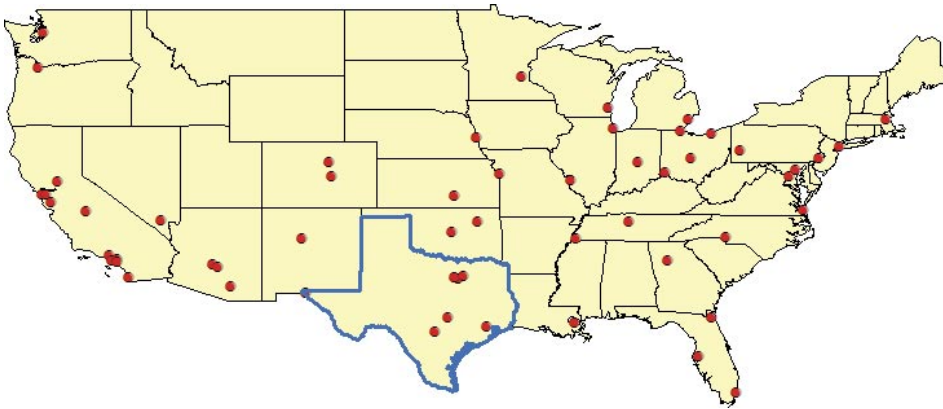
Select button

- 1 From the Tools toolbar, click the **Select Features** button.



- 2 Click inside any of the **US States** polygons.

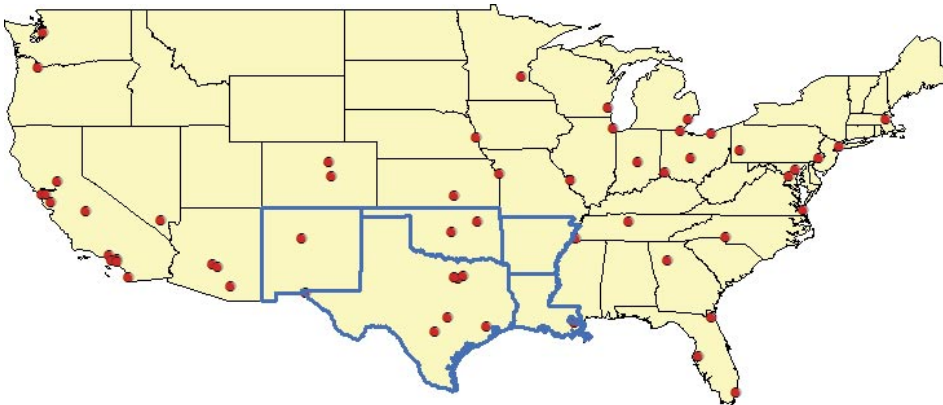
The state will be highlighted with a thick, bright blue line.



Selecting multiple features

- 1 Hold down the **Shift** key and click inside multiple states.

All of the selected states will be highlighted with a thick, bright blue line.

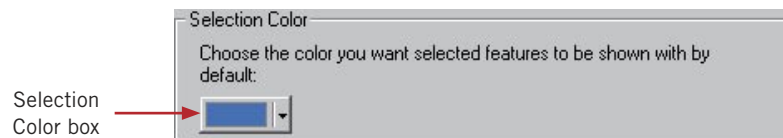


Clearing selected features

- 1 Click **Selection**, **Clear Selected Features**, or click once anywhere outside the features on the map.

Selection Color

- 1 Click **Selection**, **Options**.
- 2 Click the color box in the **Selection Color** frame.



- 3 Pick a new color.



- 4 Click **OK**.

Changing selection symbol

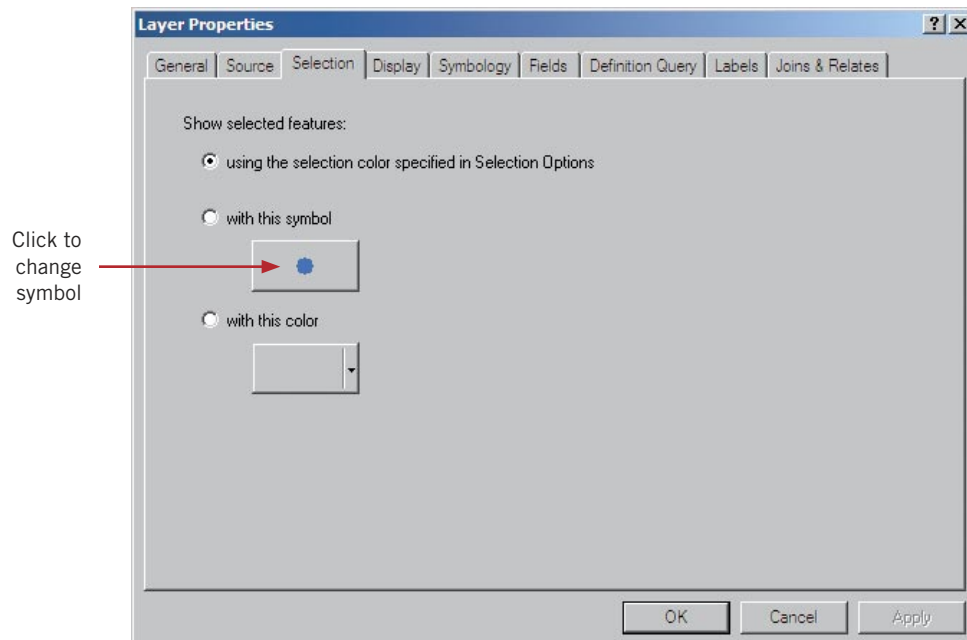
1 Right-click the layer **US Cities** in the table of contents.

2 Click **Properties**.

Note that the resulting Layer Properties window is one that you will use often. It allows you to modify many properties of a map layer.

3 Click the **Selection** tab.

4 Pick a new symbol and/or color for the point features.

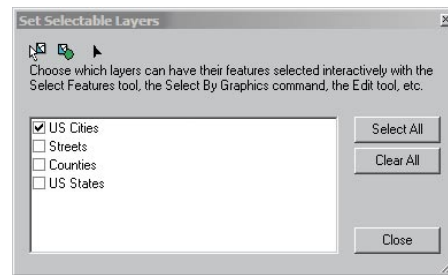


5 Click **OK**.

Selectable layers

Making a layer selectable allows features to be selected via the Select Features tool, Select by Graphics, Find tool, and so forth.

- 1 Click Selection, Set Selectable Layers.
- 2 Click off the check boxes for Streets, Counties, and US States to make only US Cities selectable.



- 3 Click Close.
- 4 Click the Select Features button  and pick a city.

That city gets the selection symbol and color that you chose on the previous page.

- 5 Clear the selected features.

YOUR TURN

Create a new layer from selected features by selecting multiple cities in one state. After the cities are selected, right-click the US Cities layer, click Selection, and click Create Layer from Selected Features.

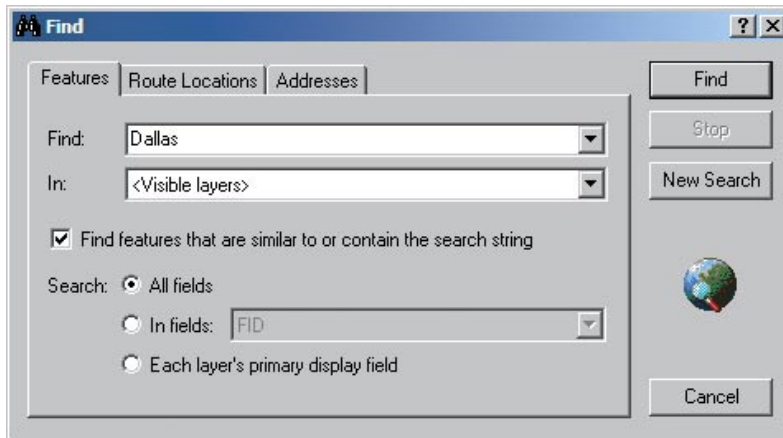
Find features

The Find tool is used to locate features in a layer or layers based on their attribute values. Once located, you can use this tool to select, flash, zoom, bookmark, identify, or unselect the feature in question.

- 1 From the Tools toolbar, click the **Find** button.

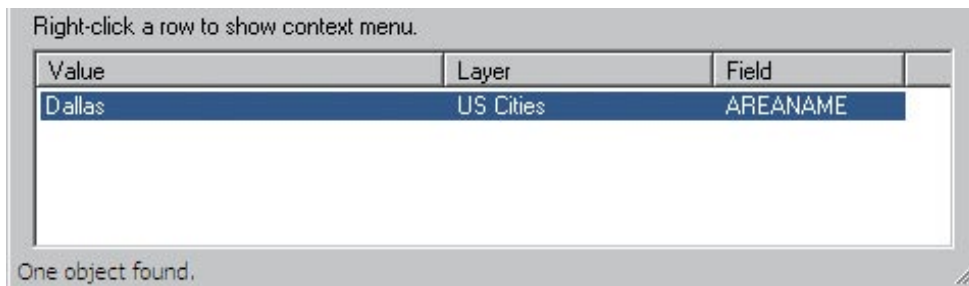


- 2 Type **Dallas** as a city name to find.

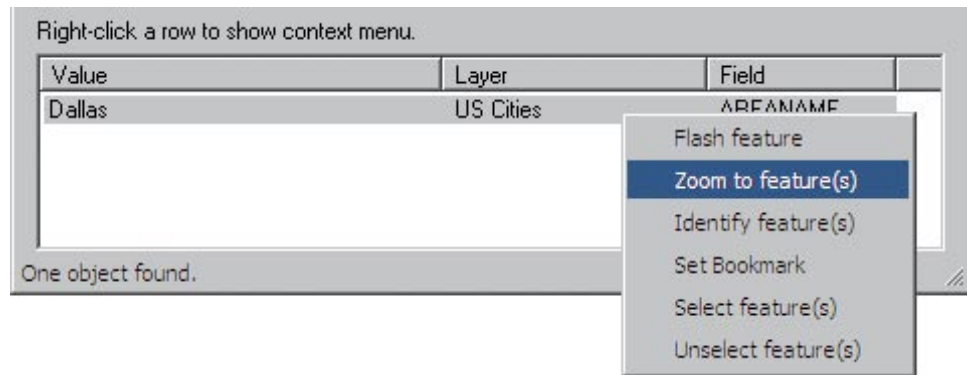


- 3 Click **Find**.

The results will appear in the following section of the Find dialog box.



- 4 Right-click the city name and click **Zoom to feature(s)**.



- 5 If necessary, clear the selected features.

YOUR TURN

Find other cities and practice showing the features using other find options; for example, Flash Features, Identify Feature(s), and Set Bookmark.

Work with feature attribute tables

Tabular attribute data associated with map features can be viewed via the layer's attribute table. To explore the attributes of a layer on a map, open its attribute table to select features and find features with particular attributes.

Open the table of the US Cities layer

1 Right-click the US Cities layer in the table of contents.

2 Click Open Attribute Table.

The table opens, containing one record for each US City point feature. Every layer has an attribute table with one record per feature.

3 Scroll down in the table until you find Chicago (the order of records may be different on your computer) and click the record selector for Chicago to select that record.

If a feature is selected on the map, it will also be selected in the attribute table. You will see this on the next page.

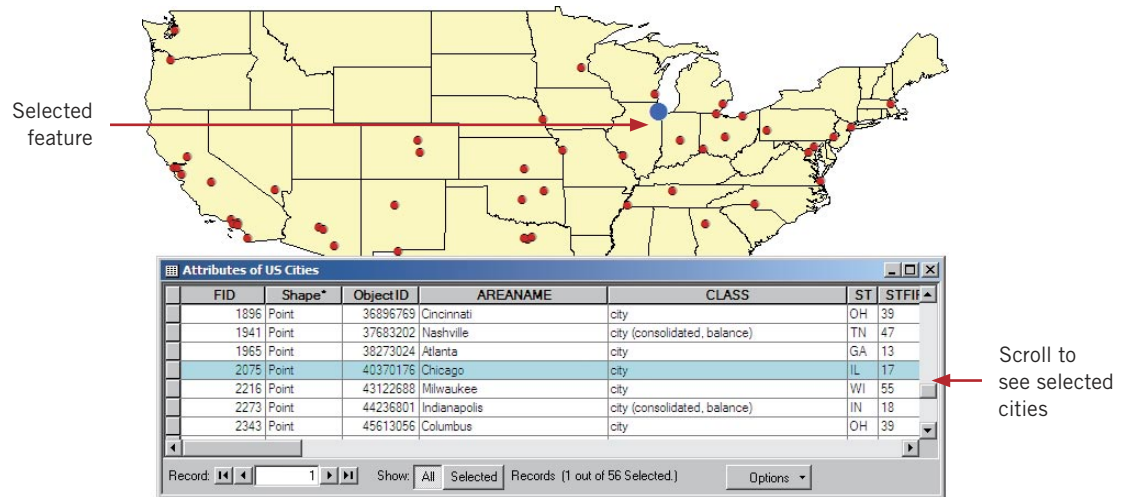
Record selector →

	FID	Shape*	ObjectID	AREANAM	CLASS	ST	STFIPS	PLACEFIP	CAPITAL	AREALAND
	1675	Point	32571395	Tampa	city	FL	12	71000	N	112.064
	1791	Point	34865153	Miami	city	FL	12	45000	N	35.673
	1821	Point	35454979	Memphis	city	TN	47	48000	N	279.318
	1896	Point	36896769	Cincinnati	city	OH	39	15000	N	77.967
	1941	Point	37683202	Nashville	city (consolida	TN	47	52006	Y	473.315
	1965	Point	38273024	Atlanta	city	GA	13	04000	Y	131.746
	2075	Point	40370176	Chicago	city	IL	17	14000	N	227.131
	2216	Point	43122688	Milwaukee	city	WI	55	53000	N	96.064
	2273	Point	44236801	Indianapolis	city (consolida	IN	18	36003	Y	361.478
	2343	Point	45613056	Columbus	city	OH	39	18000	Y	210.267
	2357	Point	45809667	Toledo	city	OH	39	77000	N	80.622
	2394	Point	46465024	Cleveland	city	OH	39	16000	N	77.58
	2477	Point	48103424	Detroit	city	MI	26	22000	N	138.768
	2578	Point	49938433	Pittsburgh	city	PA	42	61000	N	55.584
	2719	Point	52690944	Charlotte	city	NC	37	12000	N	242.267

Record: 1 Show: All Selected Records (1 out of 56 Selected.) Options ▾

Show the connection between layers and tables

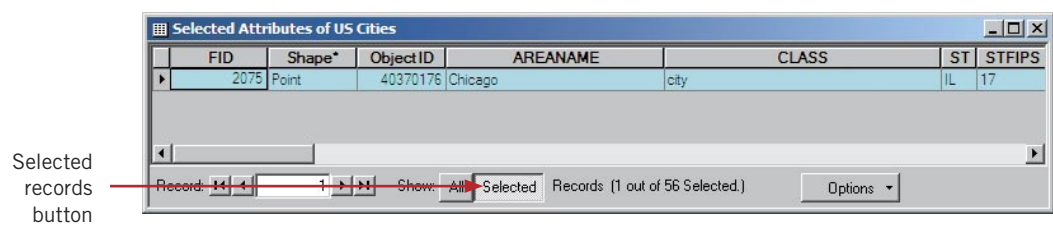
- 1 Resize the Attributes of US Cities table to see both the map and table on the screen.



- 2 Click the **Select Features** button  and click various cities on the map.
- 3 Scroll through the Attributes of US Cities to see the selected cities.

Show only selected records

- 1 In the Attributes of US Cities table, click the **Selected Records** button.



This will show only the records for the features selected in the map.

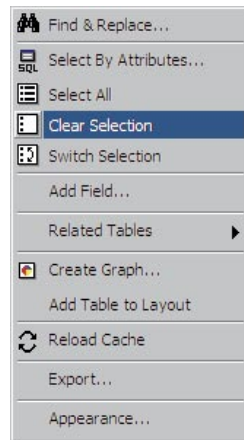
- 2 Click the **All Records** button to show all records again.

Clear selections

- 1 In the Attributes of US Cities table, click the **Options** button. (If you cannot see the Options button, widen the table to the right until it appears.)

Options ▾

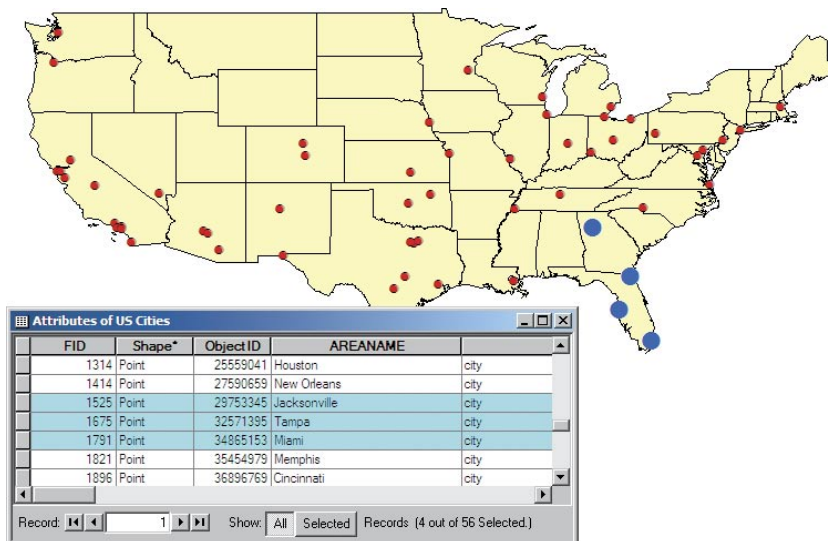
- 2 Click **Clear Selection**.



Select more than one record from the table

- 1 In the Attributes of US Cities table, click once on the record selector for **Atlanta**.
- 2 Hold down the **Ctrl** key and select the following records: **Jacksonville, Miami, and Tampa**.

This will highlight these selected features both in the Table and Map windows. Scroll up or down to find these records.

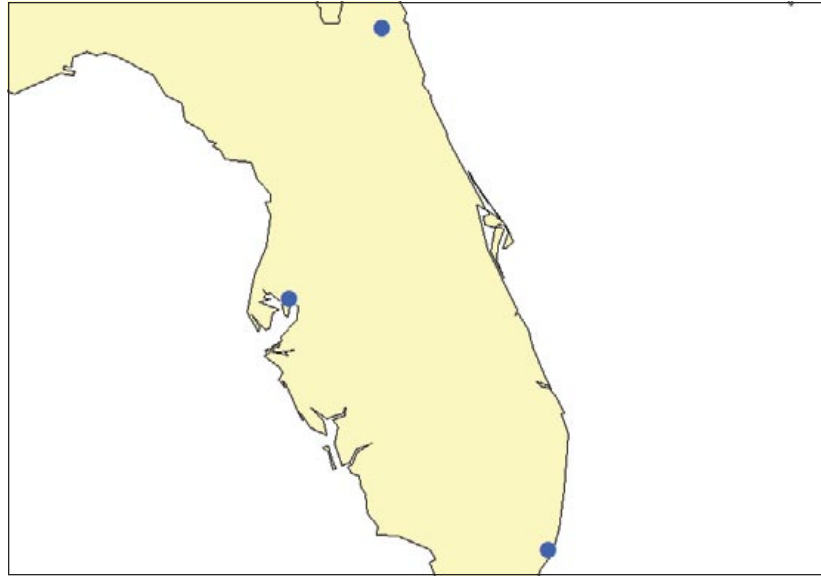


- 3 Hold down the **Ctrl** key and click the **Atlanta** record again to deselect it.

Zoom to selected feature

- 1 Click **View, Zoom Data, Zoom to Selected Features**.

This will zoom to the three selected cities in Florida.



Switch selections

- 1 In the **Attributes of US Cities** table, click the **Options** button.

Options ▾

- 2 Click **Switch Selection**.

 Switch Selection

This reverses the selection. In other words, it selects all of those that were not selected and deselects those that were selected.

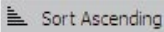
	FID	Shape*	Object ID	AREANAME	CLASS	
<input type="checkbox"/>	1223	Point	23789571	Fort Worth	city	T
<input type="checkbox"/>	1255	Point	24379392	Dallas	city	T
<input type="checkbox"/>	1280	Point	24969216	Austin	city	T
<input type="checkbox"/>	1314	Point	25559041	Houston	city	T
<input type="checkbox"/>	1414	Point	27590659	New Orleans	city	L
<input type="checkbox"/>	1525	Point	29753345	Jacksonville	city	F
<input type="checkbox"/>	1675	Point	32571395	Tampa	city	F
<input type="checkbox"/>	1791	Point	34865153	Miami	city	F
<input type="checkbox"/>	1821	Point	35454979	Memphis	city	T
<input type="checkbox"/>	1896	Point	36896769	Cincinnati	city	C
<input type="checkbox"/>	1941	Point	37683202	Nashville	city (consolidated, balance)	T
<input type="checkbox"/>	1965	Point	38273024	Atlanta	city	G
<input type="checkbox"/>	2075	Point	40370176	Chicago	city	IL
<input type="checkbox"/>	2216	Point	41122688	Milwaukee	city	W

Record: 1 Show: All Selected Records: (53 out of 56 Selected.) Options ▾

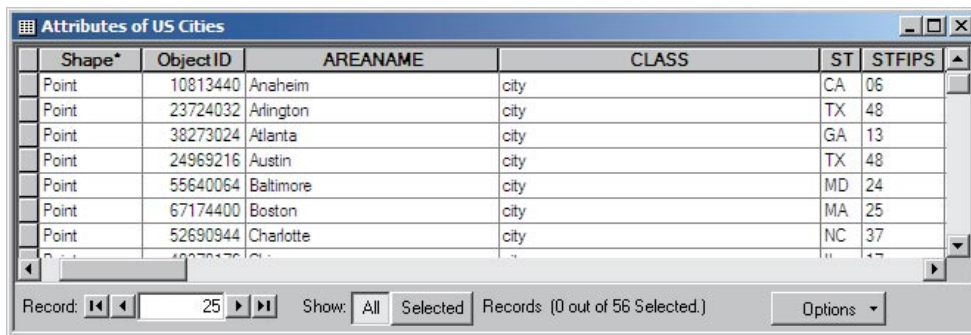
Clear selections

- 1 In the Attributes of US Cities table, click **Options** and **Clear Selection**. 

Sort a field

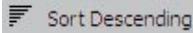
- 1 In the Attributes of US Cities table, right-click the **AREANAME** field name.
- 2 Click **Sort Ascending**. 

This will sort the table from A to Z by the name of each U.S. city.

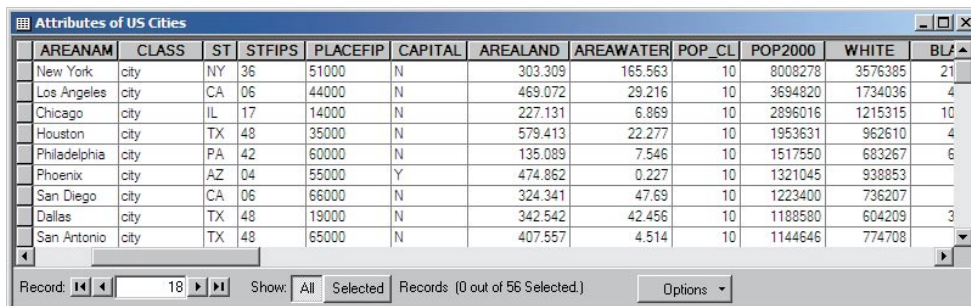


Shape*	ObjectID	AREANAME	CLASS	ST	STFIPS
Point	10813440	Anaheim	city	CA	06
Point	23724032	Arlington	city	TX	48
Point	38273024	Atlanta	city	GA	13
Point	24969216	Austin	city	TX	48
Point	55640064	Baltimore	city	MD	24
Point	67174400	Boston	city	MA	25
Point	52690944	Charlotte	city	NC	37
Point	40070176	Chicago	city	IL	17

Record: 25 Show: All Selected Records (0 out of 56 Selected.) Options

- 3 Scroll to the right in the table and right-click the **POP2000** field name.
- 4 Click **Sort Descending**. 

This will sort the field from the highest populated city to the lowest populated city.



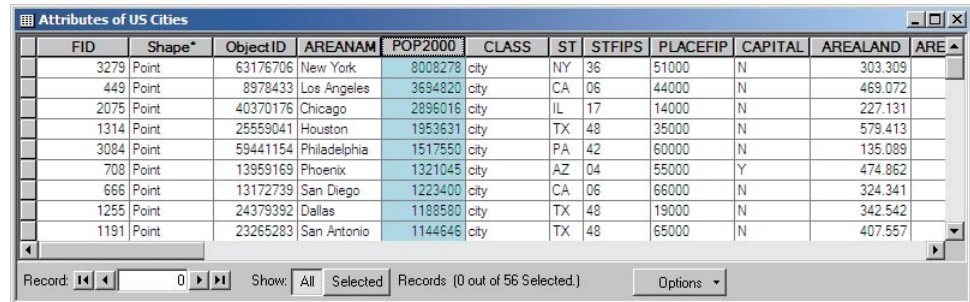
AREANAM	CLASS	ST	STFIPS	PLACEFIP	CAPITAL	AREALAND	AREAWATER	POP_CL	POP2000	WHITE	BLK
New York	city	NY	36	51000	N	303.309	165.563	10	8008278	3576385	21
Los Angeles	city	CA	06	44000	N	469.072	29.216	10	3694820	1734036	4
Chicago	city	IL	17	14000	N	227.131	6.869	10	2896016	1215315	10
Houston	city	TX	48	35000	N	579.413	22.277	10	1953631	962610	4
Philadelphia	city	PA	42	60000	N	135.089	7.546	10	1517550	683267	6
Phoenix	city	AZ	04	55000	Y	474.862	0.227	10	1321045	938853	
San Diego	city	CA	06	66000	N	324.341	47.69	10	1223400	736207	
Dallas	city	TX	48	19000	N	342.542	42.456	10	1188580	604209	3
San Antonio	city	TX	48	65000	N	407.557	4.514	10	1144646	774708	

Record: 18 Show: All Selected Records (0 out of 56 Selected.) Options

Move a field

- 1 Click the gray title of the **POP2000** field in the **Attributes of US Cities** table.
- 2 Click, drag, and release the **POP2000** field to the left of another field.

The field moves to the left of the other field(s).



FID	Shape*	ObjectID	AREANAM	POP2000	CLASS	ST	STFIPS	PLACEFIP	CAPITAL	AREALAND	ARE
3279	Point	63176706	New York	8008278	city	NY	36	51000	N	303.309	
449	Point	8978433	Los Angeles	3694820	city	CA	06	44000	N	469.072	
2075	Point	40370176	Chicago	2896016	city	IL	17	14000	N	227.131	
1314	Point	25559041	Houston	1953631	city	TX	48	35000	N	579.413	
3084	Point	59441154	Philadelphia	1517550	city	PA	42	60000	N	135.089	
708	Point	13959169	Phoenix	1321045	city	AZ	04	55000	Y	474.862	
666	Point	13172739	San Diego	1223400	city	CA	06	66000	N	324.341	
1255	Point	24379392	Dallas	1188580	city	TX	48	19000	N	342.542	
1191	Point	23265283	San Antonio	1144646	city	TX	48	65000	N	407.557	

Record: 0 Show: All Selected Records (0 out of 56 Selected.) Options

- 3 Close the **Attributes of US Cities**.

YOUR TURN

Move and sort by other field names. Try sorting by multiple fields. For example, you could sort US Cities alphabetically or by whether or not they are state capitals.

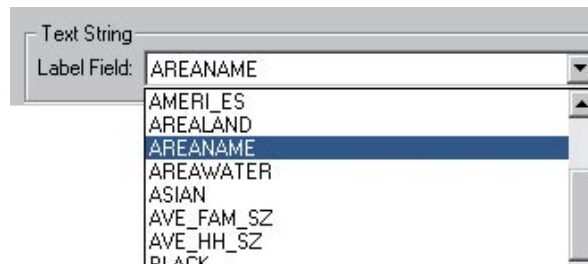
To sort by multiple fields, rearrange the table's fields so the field whose values will be sorted first appears directly to the left of the field whose values will be sorted second. While holding down the Ctrl key, click the heading of the two fields you want to use to sort the records. Right-click the name of one of the selected fields and choose a sort order. When you sort, the selected fields will be in the sort order you chose.

Label features on the map

Labels are text items on the map that are dynamically placed and whose text value is derived from one or more feature attributes.

Set label properties

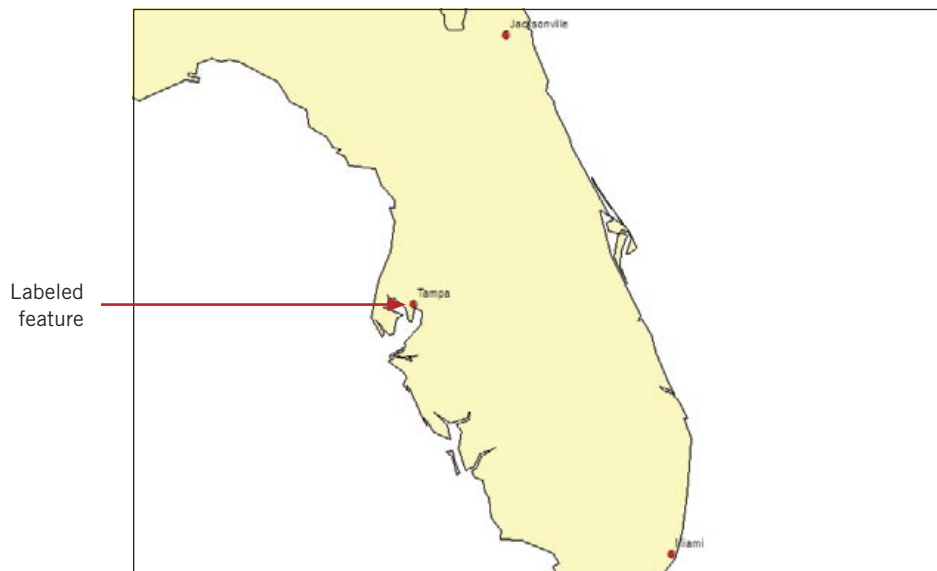
- 1 Zoom to Florida if the map is not already zoomed to that state.
- 2 Right-click the **US Cities** layer in the table of contents.
- 3 Click **Properties**.
- 4 Click the **Labels** tab.
- 5 Click the **Label Field** drop-down arrow and click **AREANAME** if not already selected.
- 6 Click **OK**.



Label features

- 1 Right-click the **US Cities** layer in the table of contents.
- 2 Click **Label Features**.

All of the features in the map will be labeled.




Remove labels

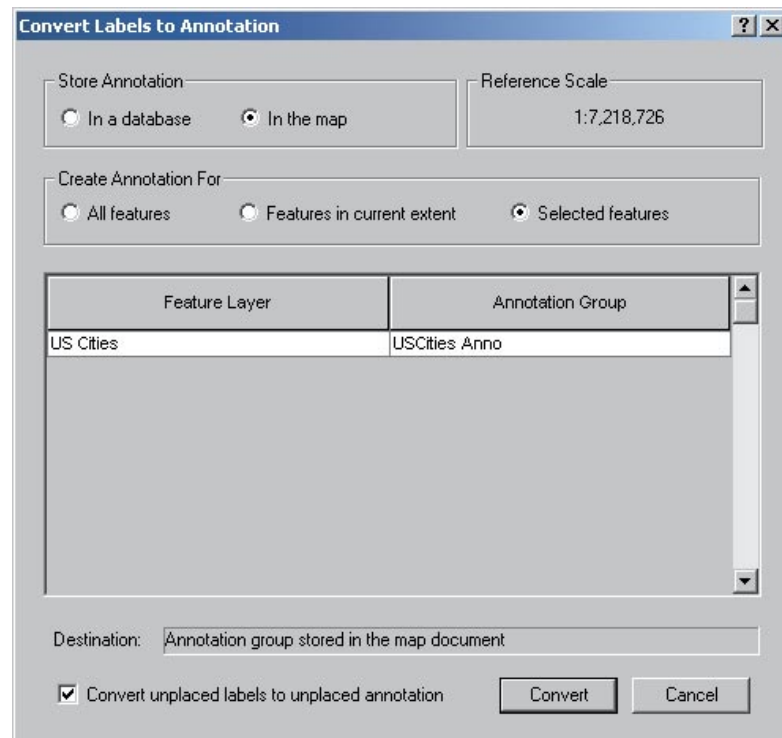
- 1 Right-click the **US Cities** layer in the table of contents.
- 2 Click **Label Features**.

Labels in the map will be turned off.

- 3 Click **Label Features** again to turn them back on.

Convert labels for selected features to annotation

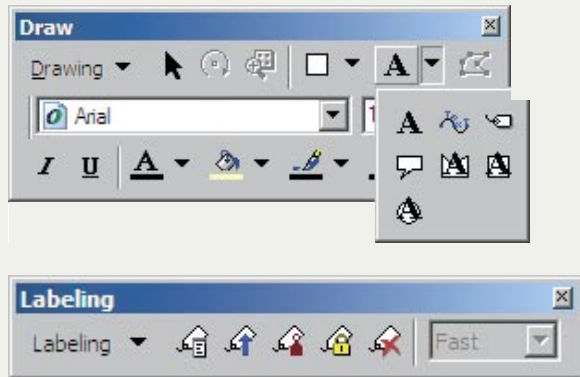
- 1 Use the **Select Features** button  to select the Florida cities if they are not already selected.
- 2 Right-click the **US Cities** layer in the table of contents.
- 3 Click **Convert Labels to Annotation**.
- 4 In the **Store Annotation** section, choose **In the map**. In the **Create Annotation For** section, choose **Selected features**.



- 5 Click **Convert**.

YOUR TURN

Explore other label commands, including Label tools from the Draw toolbar and advanced label tools from the Labeling toolbar. Explore online help for more information on labeling.



Relative paths and saving maps

When a layer is added to a map, the path name to the data is stored in the map, but the layer is not copied from its original location. When a map is opened, ArcMap locates the layer data it needs using these stored path names. If ArcMap cannot find the data for a layer, the layer will appear in the ArcMap table of contents but it won't be drawn. Instead, a red exclamation mark (!) will appear next to the layer to indicate that it needs to be repaired.

Absolute path names

An example of an absolute full path is C:\Gistutorial\Tutorial1.mxd. To share maps saved with absolute paths, everyone who uses the map must either do so on the same computer or have the data on their computer in exactly the same folder structure (e.g., C:\Gistutorial). This is not conducive for a computer lab environment since instructors, teaching assistants, and students all work on different machines. Instead, the relative path option is favored.

You can view information about the data source for a layer by clicking the Source tab in the Layers Properties box.

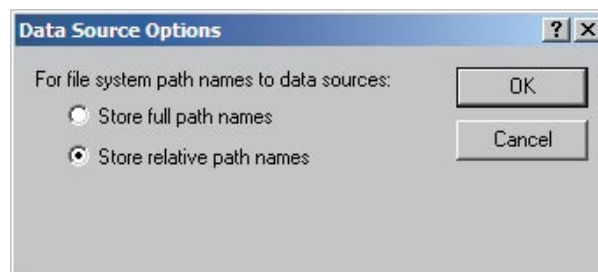
Relative path names

An example of a relative path is \Gistutorial\Tutorial1.mxd. Relative paths in a map specify the location of the layers relative to the current location on disk of the map document (.mxd file). Because relative paths do not contain drive letter names, they enable the map and its associated data to point to the same directory structure regardless of the drive that the map resides on. If a project is moved to a new drive, ArcMap will still be able to find the maps and their data by traversing the relative paths.

This option, for example, allows you to share maps that you made with data on your local F:\ drive with people who only have a C:\ drive. This also allows you to easily move the map and its data to a different hard drive on your computer, or give the map and its data to another person to copy to their computer.

Saving layers as relative path names

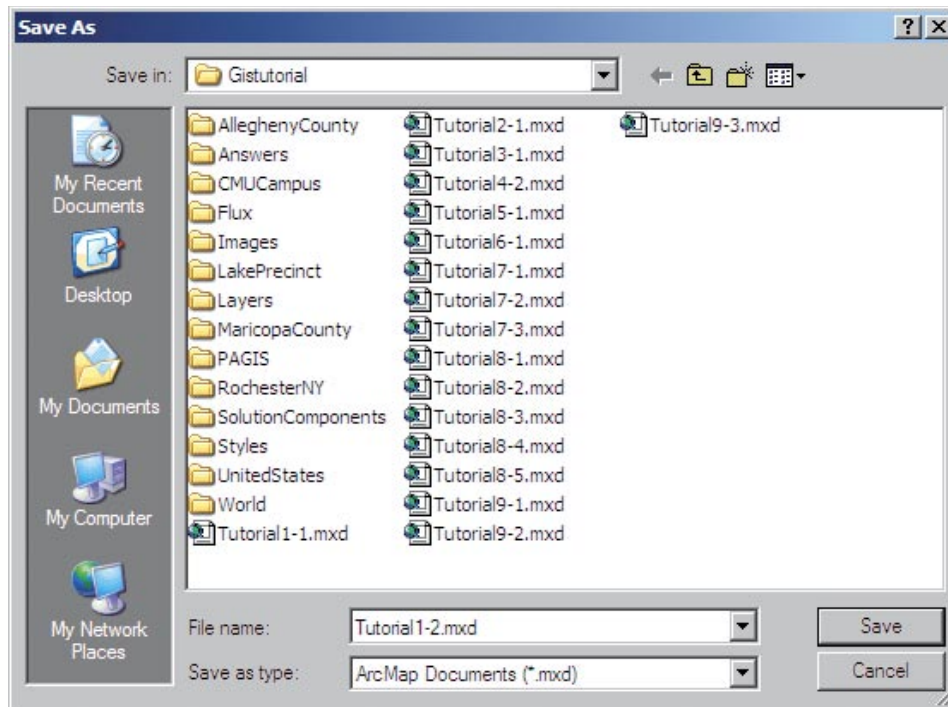
- 1 Click **File, Map Properties**.
- 2 Click **Data Source Options**.
- 3 Click the **Store relative path names** radio button.



- 4 Click **OK** and **OK** again to close the Map Properties dialog box.

Save the project and exit ArcMap

- 1 Click **File, Save As**.
- 2 Navigate to the **\Gistutorial** folder and save the map as **Tutorial1-2.mxd**.



Saving your work session in ArcMap is referred to as saving your map. When you save a map, you save it to a map document file, which has an .mxd file extension. When working with ArcMap you usually spend time setting properties that affect the look, feel, and functionality of your map and its layers. For example, in this map you added layers, changed their symbology, and created bookmarks. By saving this map, all of this work is preserved in the Tutorial 1-2.mxd file, which you can reopen anytime or share with others.

- 3 Click **File, Exit**.

Exercise Assignment 1-1

Statistics on U.S. housing

Public housing policies of the 1960s and 1970s have had many negative impacts. Many cities have public housing developments that are ghettos—often isolated by geography and with extreme poverty, low family status, and lack of amenities of almost any kind. GIS can be used to compare demographic information on housing characteristics for public housing or housing in general. In this exercise, you will compare statistics for U.S. states with the number of housing units, number of renter- and owner-occupied units, and those with the highest number of vacant units.

Start with the following:

- **\Gistutorial\UnitedStates\States**—polygon layer of U.S. states with census 2000 information.
Attributes of States table—attribute table for U.S. states that includes the following fields needed for the assignment:

HSE_UNITS	number of housing units per state
VACANT	number of vacant units
OWNER_OCC	number of owner-occupied units per state
RENTER_OCC	number of renter-occupied units per state

Change the map and get statistics

Create a new map called C:\Gistutorial\Answers\Assignment1\Assignment1-1.mxd with the above layer of the US States modified as a hollow filled color with a medium gray outline. Using the US States attribute table, select the five states having the highest number of vacant units in a bright red selection color and label these selected states only with the state name and number of vacant units for each state.

Create data document

- **Create a Microsoft® Word document called C:\Gistutorial\Answers\Assignment1\Assignment1.doc.**
- **In the Word file, create a table with statistics as follows for the five states with the highest number of vacant units only:**
 mean, minimum, and maximum number of housing units, renter occupied, owner occupied, and vacant.

Field	Mean	Minimum	Maximum
HSE_Units			
Renter_Occ			
Owner_Occ			
Vacant			

Hint: Getting statistics

- Use the Attributes of States table and right-click each field to get the appropriate statistics for the five records selected (those with the highest number of vacant units).

Exercise Assignment 1-2

Erin Street Crime Watch

Crime prevention depends very much on what the criminology literature calls “informal guardianship”—the fact that residents and their neighbors keep an eye on suspicious behavior and intervene in some fashion. Police departments therefore actively promote and support crime watch or block watch citizen groups and keep them informed on crime trends. Suppose that the police commander of a precinct has a notebook computer, ArcMap, and a portable color projector for use at crime watch meetings. Your job is to get the commander ready for a meeting with the 100 block Erin Street Crime Watch group.

Start with the following:

- **C:\Gistutorial\PAGIS\Midhill\Street.shp**—arc layer for street centerlines in the Middle Hill neighborhood of Pittsburgh. Note: This is a TIGER street centerline map from the U.S. Census Bureau. You will study and use TIGER maps extensively in GIS.

Attributes of Street table: attribute table for streets in the Middle Hill neighborhood that includes the following fields needed for the assignment:

Fname = street name

Address Ranges

LeftAdd1 = beginning house number on the left side of the street

LeftAdd2 = ending house number on the left side of the street

RgtAdd1 = beginning house number on the right side of the street

RgtAdd2 = ending house number on the right side of the street

- **C:\Gistutorial\PAGIS\Midhill\Curbs.shp**—arc layer for curbs in the Middle Hill neighborhood of Pittsburgh.
- **C:\Gistutorial\PAGIS\Midhill\Building.shp**—polygon layer for buildings in the Middle Hill neighborhood of Pittsburgh.
- **C:\Gistutorial\PAGIS\Midhill\Mid911.shp**—point layer for 911 calls in the Middle Hill neighborhood of Pittsburgh.

Attributes of Mid911 table: attribute table for mid911 points that includes the following fields needed for the assignment:

Nature_Code = call type

Date = date of crime

Address = addresses of crime locations

Change the map and get statistics

Create a new map with the above layers called C:\Gistutorial\Answers\Assignment1\Assignment1-2.mxd that includes a zoomed view of the Erin Street block selected and labeled with street names. Display streets, curbs, and buildings as medium-light gray lines, and 911 calls as bright red circles. Create a spatial bookmark of the zoomed area called Erin Street.

Create data document

- Create a list of addresses, dates of calls, and call types for crimes in the 100 block of Erin Street (see hints). Some of these will have address names of Davenport, Erin, Trent in the table. Use your word processing package to add a table of addresses in C:\Gistutorial\Answers\Assignment1\Assignment1.doc.

Address	Date	Call Type

Hints

- The 100 block of Erin Street is the segment of Erin Street whose address range is from 100 to 199 and perpendicular to streets Webster and Wylie. The complete area includes crimes between Erin/Davenport and Erin/Trent. Use both the attribute table and Identify tool to find and label these streets.
- Although it appears that there are only six points, there are actually thirteen total because some calls are at the same location. Use the Select Features button (perhaps with a window) and information in the attribute table to get the data on all relevant calls.
- Fields can be exported from the attribute table. In the table, choose “Options” and “Export.” Save the selected records to a .dbf file. Open in Microsoft Excel and paste from there to Microsoft Word.

**What to turn in**

If you are working in a classroom setting with an instructor, you may be required to submit the exercises you created in tutorial 1. Below are the files you are required to turn in. Be sure to use a compression program such as PKZIP® or WinZip® to include all three files as one .zip document for review and grading. Include your name and assignment number in the .zip document (YourNameAssn1.zip).

ArcMap projects

C:\Gistutorial\Assignments\Assignment1\Assignment1-1.mxd
C:\Gistutorial\Assignments\Assignment1\Assignment1-2.mxd

Word document

C:\Gistutorial\Assignments\Assignment1\Assignment1.doc